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Bio-efficacy and management of stem rot (*Sclerotium rolfsii*) of groundnut with different fungicides and bioagents

Sarita, Shankar Soyal and RS Ratnoo

Abstract
Groundnut (*Arachis hypogaea* L.) is an important oilseed crop throughout the world. Groundnut is infected by several fungal, bacterial and viral diseases but Stem rot caused by *Sclerotium rolfsii* is considered as one of the most devastating diseases in the groundnut growing areas of Southern Rajasthan. In *In vitro conditions Trichoderma harzianum* showed highest mycelial inhibition zone of the pathogen in comparison to *T. viride* and *T. viride* (Resident isolate). Among the fungicides Tebuconazole and Hexaconazole inhibited mycelial growth maximum at both 500 and 750 ppm concentrations. In field condition the minimum per-cent incidence was found in Tebuconazole (250, 500 and 750 ppm) which is most effective treatment among all the treatments respectively.

Keywords: fungicides, bio-agents**,** *Trichoderma, In vitro, In vivo,* tebuconazole etc

Introduction
Groundnut (*Arachis hypogaea L.*) is commonly known as peanut, manila nut, pygmy nut, pignut and monkey nut. It belongs to family *Leguminosae* or *Papilionaceae*. It is a major source of edible oil and the kernel contains 44 to 50 per cent oil and 25 to 30 per cent protein. Groundnut being a nitrogen-fixing crop through the root nodule bacteria is considered as an important crop to be cultivated in crop rotations all over the country (Desai *et al*., 1980) [4].
Groundnut crop is affected by several fungal, bacterial and viral diseases. However, only a few are economically important in India, such as fungal disease are early leaf spot (*Cercospora arachidicola*), late leaf spot (*Cercospora personata*), rust (*Puccinia arachidis*), collar rot (*Aspergillus niger*), stem rot (*Sclerotium rolfsii*), root rot (*Macrophomina phaseolina*), Alfa rot (*Aspergillus flavus*) etc (Singh and Mathur, 1953) [8]. Due to soil borne nature & long survival as sclerotial bodies it is difficult to control either by fungicides or resistance breeding. The application of fungicides though effective, but uneconomical, may affect associated micro biota in soil and has problem of environmental hazards. Thus, the harmful effects of fungicides on soil mycoflora, possibility of development of resistance against fungicide by pathogenic fungi, high cost of chemicals due to their repeated application for soil borne pathogen and a great demand for residue free product in the domestic and international markets, necessitate development of eco-friendly management system for disease control.

Material and Method
A. Bioagents
In vitro, screening of bio agents was done by dual culture technique (Dennis and Webster, 1971) [3]. The following biocontrol agents were used for study *viz*., *Trichoderma harzianum, T. viride* (IARI isolate) and *Trichoderma viride* (Resident / Local isolate). All the biocontrol agents were obtained from Department of Plant Pathology, Rajasthan College of Agriculture, MPUAT, Udaipur. Single colonies of the isolate were sub-cultured in PDA and stored in refrigerator to maintain their genetic purity. Twenty-five ml of PDA medium was poured into sterile Petri plate and allowed for solidification. Five mm diameter discs from actively growing colony of pathogen was cut with a sterile cork borer and placed near the periphery of PDA plate. Similarly, biocontrol agents were placed on the other side *i.e.*, at an angle of 180˚. Plates with no antagonists served as control for the pathogen. The plates were incubated at 27 ± 1˚ C for seven days. In each treatment three replications were maintained. The extent antagonistic activity by biocontrol agent was recorded after incubation period of 7 days by

measuring the growth of the test pathogen in dual culture and in control plates. The per cent mycelial inhibition zone of pathogen was calculated using following formula:

$$PDI = \frac{(C-T)}{C} \times 100$$

Where,
I = Per cent mycelial inhibition zone
C = Growth of fungal plant pathogen in control (mm)
T = Growth of fungal plant pathogen in dual culture plate (mm)

B. Fungicides

Four fungicides were evaluated *in vitro* with three (250, 500 and 750 ppm) concentrations against the *S. rolfsii* to find out per cent inhibition on growth of the pathogen in culture by poisoned food technique (Schmitz, 1930) [7]. Requisite quantity of each fungicide was incorporated in sterilized PDA medium, thoroughly mixed by shaking prior to pouring in sterilized Petri plates and were allowed to solidify. These Petri plates were inoculated with 5 ml suspension of seven day old culture of the pathogen in the centre of the plate and incubated at 27 ± 1˚C. Each treatment was replicated thrice with suitable control. The efficacy of fungicides in each treatment and average of three replications were calculated. Per cent mycelial growth inhibition was calculated by above given formula.

C. Field experiment

Field experiment was conducted during *kharif* seasons of the year 2017-18 at CTAE farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur to manage the stem rot of Groundnut. The management of *S. rolfsii* under field conditions through *In vitro* tested biocontrol agents and chemicals. Selected 8 treatments with control were taken. Most effective two chemicals and two biocontrol agents were selected for evaluation of their efficacy against the *Sclerotium* stem rot of groundnut. Soil application of fungicides at the rate of 0.1% and 0.2% at 45 and 60 DAS. According to recommended rate *T. viride* and *T. harzianum* were added @ 10g/kg + 2.5 kg CF/100kg FYM (Furrow application). The seeds of groundnut variety susceptible cultivar (Pratap Raj Mungphali) were sown after seed treatment by biocontrol agents 10g/kg. For each treatment three replications were maintained. Standard agronomical practices were followed as per recommendations.

Treatment details

T_1- *Trichoderma viride* 10g/kg (ST)
T_2- *Trichoderma harzinaum* 10g/kg (ST)
T_3- Hexaconazole-5EC (FS) @ 0.1% at 45 and 60 DAS
T_4- Tebuconazole-250EC (FS) @ 0.1% at 45 and 60 DAS
T_5- Carbendazim-50WP (FS) @ 0.1% at 45 and 60 DAS
T_6- Saaf (Carbendazim 12% +Mancozeb 63%)(FS) @ 0.2% at 45 and 60 DAS
T_7- *T. harzianum*- ST 10g/kg + 2.5kg CF/100kg FYM (FA)
T_8- *T. Viride*- ST 10g/kg +2.5kg CF/100kg FYM (FA)
T_9- Control
*DAS-days after showing
*CF- Chalk formulation
*FA-Furrow application
*FS-Foliar spray
*ST-Seed Treatment

Formula

$$\text{Per cent disease incidence} = \frac{\text{PDI in Control} - \text{PDI in Treatment}}{\text{PDI in Control}} \times 100$$

Results and Discussion

A. Bioagents

Biological control is much significance in view of hazards caused by toxic chemicals or in a situation where pathogens develop resistance against fungi toxicants. The bio agents were evaluated against *S. rolfsii* on PDA by dual culture technique. The result reveals that the antagonistic actions of three biocontrol agents *viz*., *Trichoderma harzianum*, *T. viride* and Resident isolates (*Trichoderma viride*). Based on observations of radial growth of antagonist and test fungus, per cent inhibition was calculated.The results revealed (Table. 1and Fig.1) that all biocontrol agents were significantly superior in inhibiting the growth of test fungus over the control. Maximum growth inhibition was recorded in *T. harzianum* (72.04%) followed by *Trichoderma viride* (Resident isolate) (66.11) and *T. viride* (61.85%) (Thribhuvanamala *et al.*, 2000) [10].

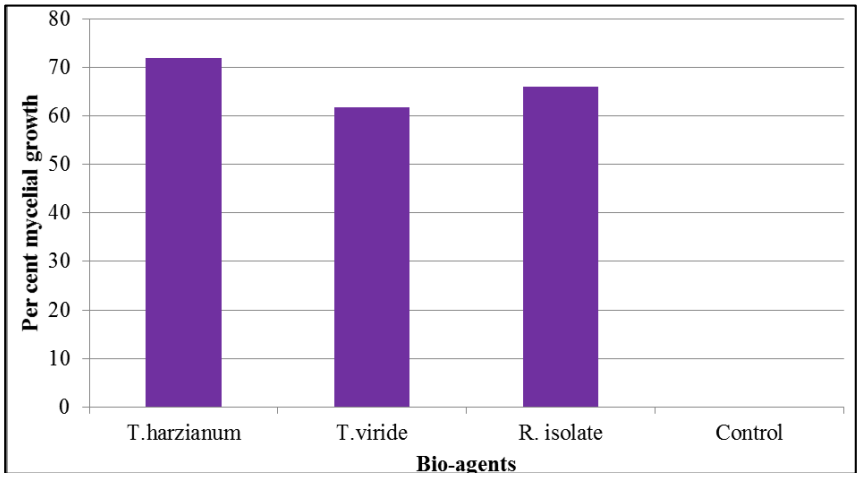

Fig 1: *In-vitro* efficacy of different bio agents against *Sclerotium rolfsii* after 7 days at 27 ± 1^0C

Table 1: *In-vitro* efficacy of different bioagents against *Sclerotium rolfsii* after 7 days at 27 ± 1^{0}C

S. No.	Bio agent	Per cent mycelial inhibition zone*
1.	*Trichoderma harzianum*	72.04 (58.08)
2.	*Trichoderma viride*	61.85 (51.85)
3.	Resident isolate *(Trichoderma viride)*	66.11 (54.40)
4.	Control	0.00 (0.00)
	SEm±	0.78
	CD (p=0.05)	2.70

*Average of three replications
Figures given in parentheses are angular transformed values

B. Fungicides

The efficacy of fungicides was evaluated against *S. rolfsii* on PDA by poisoned food technique. The result reveals (Table. 2 and Fig. 2) that increase in concentration of the fungicides caused increased inhibition of mycelial growth of the fungus. Among these, Tebuconazole inhibited maximum mycelial growth of *S. rolfsii* 89.26% and 93.71% at both concentrations (500 and 750 ppm) followed by Hexaconazole with inhibition of 65.55, and 76.66 % and Saaf with inhibition of 47.41% and 61.11% respectively. Carbendazim was found least effective in mycelial growth inhibition on 20.00 and 28.15 % in both concentrations against *S. rolfsii* tebuconazole was the most effective fungicide at all the concentrations tested as it provided cent percent growth inhibition (Kulkarni *et al.*,1986 and Amreen *et al.*, 2014) [1, 5].

Table 2: *In vitro* Efficacy of fungicides against *Sclerotium rolfsii* after 7 days of incubation at 27± 1^{0}C

S. No.	Fungicide	Per cent mycelial growth inhibition at various* concentrations (ppm)			
		250	500	750	Mean
1.	Hexaconazole	53.71 (47.13)	65.55 (54.06)	76.66 (61.11)	65.30
2.	Carbendazim	3.33 (10.51)	20.00 (26.57)	28.15 (32.04)	17.16
3.	Saaf	41.48 (40.09)	47.41 (43.52)	61.11 (51.42)	50.00
4.	Tebuconazole	81.11 (64.24)	89.26 (70.87)	93.71 (75.48)	88.02
5.	Control	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00
	Mean	44.90	55.55	64.90	
		SEm±	CD (p=0.05)		
	F	0.32	0.93		
	C	0.25	0.72		
	F x C	0.55	1.61		

* Average of three replications

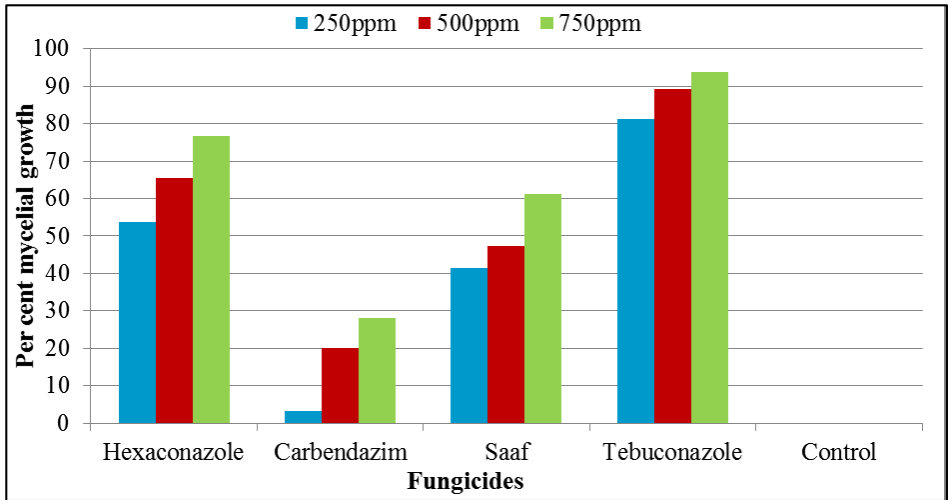

Fig 2: *In vitro* Efficacy of fungicides against *Sclerotium rolfsii* after 7 days of incubation at 27 ± 1^{0}C

C. Field experiment

The fungicides and bio-agents which were found most effective in single applications experiment, further; they were tested in combinations in Random Block designed in the field. The result reveals (Table: 3, Figure: 3) that Tebuconazole (T_4) (5.2%) which is most effective treatment among all the treatments. The next effective treatment was *T. harzianum* + FYM (T_7) (12.5 per cent) and Hexaconazole (T_3) (14.2 per-cent). While *T. viride* (T_1) was found least effective treatment with maximum per-cent disease incidence of (38.4 per cent) and followed by *T. harzianum* (T_2) (29.3%), *T. viride*+ FYM (T_8) (27.2%), Carbendazim (T_5) (24.5%) and Saaf (T_6) (23.3%). Combined treatments were better effective over their individual applications as well as over the untreated control. It was closely followed by *T. harzianum* with FYM and chalk formulation. These results are in accordance with the results of Kulkarni (2007) [6], Basamma Kumar (2008) [2] and Sunkad (2012) [9]. However, a per-cent disease incidence decrease over control was observed that the treatment Tebuconazole was found best and followed by Hexaconazole and *T. harzianum* with FYM had decrease the per-cent incidence. The least effective treatment was Carbendazim had minimum decrease in plant mortality.

Table 3: *In vivo* efficacy of fungicides and bio control agents against *S. rolfsii*

S. No.	Treatments	Per cent disease incidence*		
		30 DAS	45 DAS	60 DAS
1.	*Trichoderma viride* (ST)	27.0 (31.3)	33.5 (33.3)	38.4 (38.2)
2.	*Trichoderma harzinaum* (ST)	20.5 (26.92)	25.2 (30.1)	29.3 (32.7)
3.	Hexaconazole (FS) at 45 and 60 DAS	18.5 (25.4)	14.4 (22.3)	14.2 (22.1)
4.	Tebuconazole (FS) at 45 and 60 DAS	7.8 (16.2)	5.4 (13.4)	5.2 (13.1)
5.	Carbendazim (FS) at 45 and 60 DAS	35.4 (36.5)	29.6 (32.9)	24.5 (29.6)
6.	Saaf (FS) at 45 and 60 DAS	30.0 (33.2)	27.0 (31.3)	23.3 (28.8)
7.	*T. harzianum* (ST) + FYM (FA)	11.6 (19.9)	12.5 (20.7)	12.5 (20.7)
8.	*T. Viride*- (ST) + FYM (FA)	20.0 (26.5)	22.5 (28.3)	27.2 (31.4)
9.	Control	35.5 (36.5)	65.4 (53.9)	69.2 (56.2)
	SEm±	0.72	0.67	0.67
	CD	2.15	2.01	1.99

*Average of three replications.
Figures given in parentheses are angular transformed values
(ST- Seed treatment; FA- furrow application; FS- foliar spray; CF- chalk formulation)

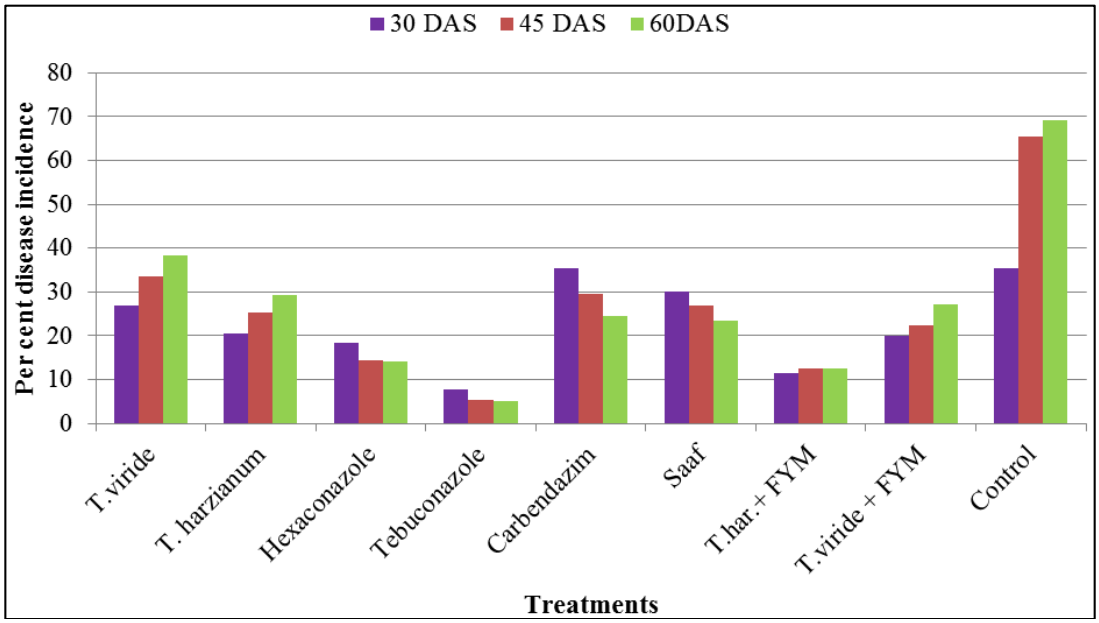

Fig 3: *In vivo* efficacy of fungicides and bio control agents against *S. rolfsii*

References

1. Amreen T, Kumar NK, Kumar VBS. Fungicidal evaluation and physiological studies of *Sclerotium rolfsii* causing collar root of capsicum. Environment and Ecology. 2014; 32:758-761.
2. Basamma Kumar. Integrated Management of *Sclerotium Wilt* of Potato Caused by *Sclerotium rolfsii* Sacc, Thesis Submitted to the University of Agricultural Sciences, Dharwad, 2008.
3. Dennis C, Webster J. Antagonistic properties of species groups of *Trichoderma* - III. Production of volatile antibiotics. Trans. Br. mycol. Soc. 1971; 51:363-369.
4. Desai BK, Kotecha PM, Salunkhe DK. Science and Technology of Groundnut biology, Production, Processing and Utilization. Naya Prakash, Calcutta, 1980, 185.
5. Kulkarni S, Chattannavar SN, Hegde RK. Laboratory Evaluation of fungicides against foot rot of wheat caused by *S. rolfsii* Sacc. Pesticides, 1986; 9:27-31.
6. Kulkarni VR. Epidemiology and Integrated Management of Potato Wilt Caused by *Sclerotium rolfsii* Sacc, M.Sc. (Agri.) Thesis, Univ. Agri. Sci., Dharwad, 2007.
7. Schmitz H. *Poisoned food technique*. Second Edn. Industry of Engineering Chemical. London, U.S.A, 1930, 333-361.
8. Singh B, Mathur SC. Sclerotial rot disease of groundnut in Uttar Pradesh. Curr. Sci. 1953; 22: 214-215.
9. Sunkad G. Tebuconazole: A New triazole fungicide molecule for the management of stem rot of groundnut caused by Sclerotium rolfsii. The Bioscan. 2012; 7(4):601-603.
10. Thribhuvanamala E, Rajeshwari, Sabitha P. Biological control of tomato caused by *Sclerotium rolfsii*. The Madras Agril. J. 2000; 86:30-31.